OVALOCYTOSIS AND MALARIA IN NAPU VALLEY, CENTRAL SULAWESI, INDONESIA

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ABSTRAK

Pada Penelitian di 3 desa, Tamadue, Maholo dan Winowanga di Lembah Napu, Sulawesi Tengah, didapatkan prevalensi ovalositosis pada penduduk masing-masing sebesar 26%, 25% dan 14%. Dari jumlah penduduk 371 yang diperiksa darahnya dari ketiga desa tersebut 22% menderita ovalositosis dengan 7% di antaranya menderita malaria. Sedangkan dari sisanya 78% penduduk yang mempunyai sel darah merah normal, 20% di antaranya menderita malaria. Perbedaan ini ternyata bermakna, sehingga ada korelasi antara ovalositosis dengan infeksi malaria. Ada kecenderungan golongan anak umur 2-9 tahun yang mempunyai ovalositosis dalam darahnya akan lebih resisten terhadap infeksi malaria dibanding golongan umur yang lain. Selain *P. falciparum*, juga *P. vivax* dan *P. malariae* lebih banyak dijumpai pada penderita yang mempunyai sel darah merah normal daripada penderita yang mempunyai sel darah oval.

INTRODUCTION

Ovalocytosis has a wide distribution in the Indonesian archipelago (Sofro, 1986)[1]. The frequency of ovalocytosis ranged from 0.25% in the Javanese to 23.7% in the Rotinese examined in his study. Bonne and Sandground (1939)[2] reported that half of the population in several villages near Lake Lindu in Central Sulawesi had ovalocytosis. Based on data collected from the Temuan of Malaysia, Baer et al. (1976)[3] hypothesized that individuals with ovalocytosis are resistant to infection with malaria. Serjeantson et al. (1977)[4] showed that in Papua New Guinea ovalocytosis is associated with resistance to severe malaria infections. Furthermore, individuals with ovalocytosis were more resistant to *Plasmodium vivax* and *P. malariae* infections, but not to *P. falciparum*. *In vitro* studies show that ovalocytes are resistant to invasion by *P. falciparum* (Kidson et al., 1981; Hadley et al., 1983)[5,6] and *P. knowlesi* (Hadley et al., 1983)[6]. We examined the frequency of ovalocytosis in three villages located approximately 50 km southeast of Lake Lindu in Napu Valley, Central Sulawesi and the relationship of ovalocytosis to malaria prevalence in this population.

MATERIALS AND METHODS

The study villages, Maholo, Winowanga and Tamadue, are located in Central Sulawesi, Indonesia at 1° 27' south and 120°26' east, at an altitude of 1100 meters above sea level. A more detailed description of the area was reported by Carney et al. (1974)[7]. Thick and thin blood smears from 117 residents of Winowanga, 154 residents of Maholo and 100 residents of Tamadue were prepared in March 1987 at the start of the dry season. Slides were stained with Giemsa and examined for malaria parasites and ovalocytic red blood cells.

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RESULTS

The prevalence of malaria by village and age group is shown in Table 1. The highest prevalence of malaria was found in the two-to nine-year-olds. Infections with *P. falciparum* were the most common.

The frequencies of ovalocytosis with malaria and normal red blood cells with malaria in residents of the three villages are shown in Table 2.

Tabel 1. Prevalence of malaria in individuals with ovalocytosis and in individuals with normal red blood cells by age group and village.

Age group (years)	Village**	Total # examined	Percent* with. P.f.+ ov++	P.f.+ norm	P.v. ov	P.v. norm	P.m. ov	P.m. norm	TOTAL
0 – 1	T	4	0	0	0	0	25(1)	0	25 (1)
	M	7	0	14 (1)	0	0	0	0	14 (1)
	W	1	0	0	0	0	0	0	0 (0)
2 – 9	T	35	3 (1)	20 (7)	0	20 (7)	0	3 (1)	46 (16)
	M	75	0	10 (8)	0	3 (2)	0	0	13 (10)
	W	50	0	16 (8)	0	8 (4)	0	0	24 (12)
10 – 14	T	18	11 (2)	33 (6)	0	6 (1)	0	0	50 (9)
	M	13	8 (1)	15 (2)	0	0	0	0	23 (3)
	W	34	3 (1)	15 (5)	0	3 (1)	0	0	21 (7)
⩽ 15	T	43	0	7 (3)	0	0	0	0	7 (3)
	M	59	0	0	0	3 (2)	0	0	3 (2)
	W	32	0	0	0	3 (1)	0	0	3 (1)
All ages	T, M, W.	371	1 (5)	11 (40)	0	5 (18)	0.3(1)	0.3(1)	17 (65)

* Percent of individuals screened were slide positive for each malaria species, with the number of positive individuals in parentheses.

** T = Tamadne, M = Maholo, W = Winawanga

\+ Pf · *Plasmodium falciparum*, Pv . *P. Vivax*. Mm · *P. malaria*

++ Ov = Ovaloceptosis, norm · normal red blood cells.

Table 2. Frequency of ovalocytosis and malaria in individuals with ovalocytosis and in individuals with normal red blood cells by age group and village.

Age group (years)		Total # Examined	Percent* with			
			Ovalocytosis	Ovalocytosis and malaria	Normal RBCS	Normal RBCS and malaria
0 – 1	T	4	75 (3)	33 (1)	25 (1)	0
	M	7	14 (1)	0	86 (6)	14 (1)
	W	1	0	0	100 (1)	0
2 – 9	T	35	20 (7)	14 (1)	80 (28)	57 (16)
	M	75	15 (11)	0	85 (64)	16 (10)
	W	50	10 (5)	0	90 (45)	27 (12)
10 – 14	T	18	28 (5)	40 (2)	72 (13)	54 (7)
	M	13	23 (3)	33 (1)	77 (10)	20 (2)
	W	34	15 (5)	20 (1)	85 (29)	21 (6)
⩽ 15	T	43	26 (11)	0	74 (32)	9 (3)
	M	59	41 (24)	0	59 (35)	3 (1)
	W	32	19 (6)	0	81 (26)	4 (1)
All ages	T, M, W	371	22 (81)	7 (16)	78 (290)	20 (59)

* Percent of individuals screened who had ovalocytosis, ovalocytosis with malaria, and normal red cells with malaria. Number of individuals is in parentheses.

** T = Tamadue, M = Maholo, W = Winowanga.

Ovalocytosis was found in 26% of the residents of Tamadue, 25% of Maholo residents and 14% of Winowanga residents screened. Overall, 22% of the population screened had ovalocytosis and 7% with ovalocytosis had malaria. In comparison, 20% of the individuals with normal red blood cells had malaria. The overal parasite rate in ovalocytics was significantly lower than in individuals with normal red blood cells ($X^2 = 6.18$; $p = 0.013$). However, when the data is examined by age group the advantage of ovalocytosis was seen only in the 2 to 9 year olds, not in the other age groups. All persons with malaria and ovalocytosis had *P. falciparum* infections except for one child below the age of two who had *P. malariae*.

DISCUSSION

An advantage conferred by ovalocytosis to residents of a malarious area in Napu Valley, Central Sulawesi was seen in two-to nine-year olds who were resistant to infection with malaria. Only one of the two to nine year olds with ovalocytosis had malaria, while 16% to 57% of those with normal red blood cells had malaria *(P. falciparum, P. vivax* or *P. malariae)* at the time of screening.

In all age groups, *P. falciparum* was the only malaria species found in ovalocytics, except one child below the age of two who had an infection of *P. malariae*. This is in agreement with the results of Serjeantson et al. (1977) who found that there was a significantly reduced rote of *P. vivax* and *P. malariae* in ovalocytics. However, in contrast to this results we observed an age-specific resistance of individuals with ovalocytosis to infection with all species malaria. Since the sample size in this study was small, additional malaria surveys of this population should be done at different times of the year to confirm that individuals with ovalocytosis are resistant to infection with malaria and that the advantage is age-specific.

ACKNOWLEDGEMENTS

We thank Prof. Dr. A. A. Loedin and Dr. D. C. Edman for their support and help in making this study possible.

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